Game Changing Development

Hypersonic Inflatable Aerodynamic Decelerator II (HIAD2)

Completed Technology Project (2015 - 2017)

Project Introduction

Develop and qualify materials, control mechanisms, and structural design concepts guided by potential mission architectures. Demonstrate performance through ground-based and flight testing at Earth.

Anticipated Benefits

Benefits to NASA Funded Missions: A Hypersonic Inflatable Aerodynamic Decelerator(HIAD) is an entry and descent technology to enhance, and enable, robotic and scientific missions to destinations with atmospheres such as Mars, Venus, Titan, and the gas giants. Due to the flexible softgoods, the aeroshell can be packaged into small volumes, stowed for long durations, and deployed prior to entry at a destination. The aeroshell can be manufactured to accommodate large scale aeroshell, and offers NASA the ability to down mass approximately 20x's higher mass than current rigid aeroshell technology. Benefits to NASA Unfunded & Planned Missions: The technology is a significant increases in down mass capability for NASA, allowing up to 40 metric tons. This technology can also be applied to returning assets to Earth such as launch vehicle asset recovery, International Space Station (ISS) down mass or sample return capsules. Not only is this down mass technology applicable to robotic vehicles, it should also be scalable to crewed missions (Mars entry or Earth return from LEO and beyond). Benefits to Other Government Agencies. Reduced cost for access to space has direct benefit to any other agency utilizing ULA launch services (commercial space access company). Benefits to the Commercial Space Industry: HIAD technology has been identified as a key enabling technology for ULA's SMART Reuse technology. SMART Reuse is a design being developed where the first stage booster engines are recovered and reused. After launch and separation of the second stage and payload, the VULCAN engines are separated from the first stage booster can, a HIAD is then used to decelerate the engines to subsonic conditions where a parafoil is used prior to being air-captured by a heavy mass helicopter (ex. CH47-Chinook/King Air/Skycrane/etc.). ULA intends to utilize HIAD on future missions to reduce launch costs. Benefits to the Nation: Reduced cost on launch vehicles directly impacts nations ability to access space, and is a strategic advantage to enabling future missions.

Hypersonic Inflatable Aerodynamic Decelerator II

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Game Changing Development

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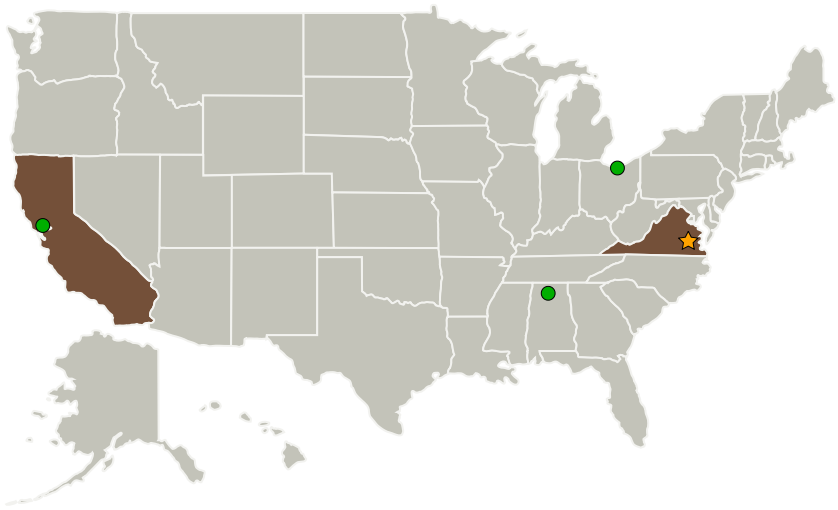
Primary U.S. Work Locations and Key Partners



Project Management

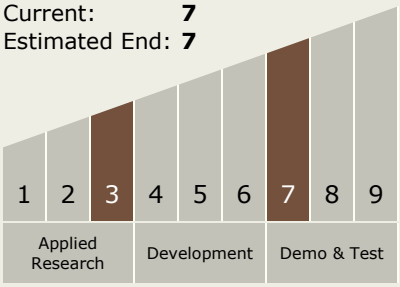
Program Director:
Mary J Werkheiser

Program Manager:
Gary F Meyering

Principal Investigator:
Richard B Bryant

Technology Maturity (TRL)

Start: **3**
Current: **7**
Estimated End: **7**



Target Destinations

Mars, Earth

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Organizations Performing Work	Role	Type	Location
★Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Airborne Systems North America of CA, Inc.	Supporting Organization	Industry	
●Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California
Aspen Aerogels, Inc.	Supporting Organization	Industry	Northborough, Massachusetts
Atkins & Pearce	Supporting Organization	Industry	
Bally Ribbon Mills(BRM)	Supporting Organization	Industry	Bally, Pennsylvania
Carolina Narrow Fabric	Supporting Organization	Industry	
Conax Florida NextGen Inflation System	Supporting Organization	Industry	Florida
Georgia Institute of Technology-Main Campus(GA Tech)	Supporting Organization	Academia	Atlanta, Georgia
●Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio
ILC Dover	Supporting Organization	Industry	Newark, Delaware
Jackson Bond Enterprises LLC	Supporting Organization	Industry	
Lockheed Martin Inc.	Supporting Organization	Industry	Palo Alto, California
●Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

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Organizations Performing Work	Role	Type	Location
National Institute of Aerospace	Supporting Organization	Academia	Hampton, Virginia
Navy	Supporting Organization	US Government	
SGL Cargon, LLC	Supporting Organization	Industry	
Southwest Research Institute - San Antonio(SWRI)	Supporting Organization	Academia	San Antonio, Texas
Textum Weaving, Inc.	Supporting Organization	Industry	
United Launch Alliance	Supporting Organization	Industry	
University of Maine	Supporting Organization	Academia	Orono, Maine
University of Vermont	Supporting Organization	Academia	Burlington, Vermont

Primary U.S. Work Locations	
California	Virginia

Project Transitions

April 2015: Project Start

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September 2017: Closed out

Closeout Summary: HIAD2 does not have any TRL advancement planned in FY17. They have successfully been transitioned to TDM for FY18 for a flight project with ULA. The HIAD-2 project focused on technology demonstration risk reduction activities required to support deployable entry vehicle systems. Deployable entry vehicles are identified as the leading Agency capability that will enable human Mars exploration missions. The use of large scale aeroshell designs are made possible as these systems can be stowed in much smaller volumes during launch and cruise, and then deployed exo-atmospherically to generate the deceleration needed to safely and reliably land heavy payloads to the surface. The HIAD-2 project extended the textile manufacturing methods required to produce articles with diameters greater than ten meters, advanced guidance and control concepts, and generated ground-based experimental data needed to anchor thermal and structural design tools for mission architecture studies. The HIAD-2 project transitioned to a STMD technology demonstrator project which is collaborating with Lockheed Martin for a secondary launch asset recovery missions which can will permit reuse of high-cost hardware for the first time and provide valuable flight data needed to mature system design.

Project Website:

https://www.nasa.gov/directorates/spacetech/home/index.html